Tennessee Valley Authority
Integrated Resource Plan Stakeholder Review Group
Working Session

MEETING MINUTES

July 20 and 21, 2010
Chattanooga, TN

Day One: July 20, 2010

Members Present:
Randy McAdams, Facilitator, ScottMadden
Dana Christensen, Oakridge National Laboratory
Ryan Gooch, State of Tennessee
Louise Gorenflo, Sierra Club
Richard Holland, Packaging Corporation of America
David McKinney, Tennessee Wildlife Resource Agency
David Reister, Environmental Stakeholder
Jack Simmons, Tennessee Valley Public Power Association
Stephen Smith, Southern Alliance for Clean Energy
Lloyd Webb, Tennessee Valley Industrial Committee
Deb Woolley, Tennessee Chamber of Commerce

Members Absent:
Lance Brown, Partnership for Affordable Clean Energy
George Kitchens, Joe Wheeler Electric Membership Corporation
Henry List, Commonwealth of Kentucky
Dr. Jan Simek, University of Tennessee
Patrick Sullivan, State of Mississippi

Alternates Present:
Steve Adams, Tennessee Valley Public Power Association
Tom Midyett, Packaging Corporation of America
Brian Paddock, Sierra Club
John Wilson, Southern Alliance for Clean Energy

TVA:
Bob Balzar, Gary Brinkworth, Larry Cole, Ed Colston, Russell Dotson, Joe Hoagland, B.J. Gatten, Jill Glenn, Kim Greene, Randy Johnson, Andrew Kosnaski, Alisha Mulkey, John Myers, Chuck Nicholson, Greg Signer, Van Wardlaw, Beth Yetter, Steve Gilbert (ScottMadden)

Opening Remarks
Randy McAdams welcomed the SRG and introduced Kim Greene, Group President of Strategy and External Relations. Kim opened by thanking the SRG for their continued involvement in the IRP process. She emphasized the importance of doing an IRP and how it aids TVA in planning for the future in terms of future generation needs, investment decisions and supporting TVA's mission - the ability to provide low

rates and low bills as well as focus on environmental health, economic development, electricity production and technological innovation.

Kim informed the group that no Board decisions have been made on resuming construction at the Bellefonte site. It is still a viable option for generation but want to allow the IRP process to conclude, as with other TVA decisions. The IRP process is at the "center of the universe" of TVA and will inform which decisions need to be made and in what time frame. A question was raised on what will be discussed pertaining to Bellefonte at the Board meeting in August and it was answered that it is to approve the FY 11 budget for Bellefonte. In order to keep Bellefonte as a viable option, an FY 11 budget must be in place to carry on study work in case the IRP indicates that Bellefonte is needed in the future. No decisions on completing the units or not will be made until the IRP is complete

Kim stressed TVA's goal of implementing a cleaner energy portfolio. TVA is already ahead of many of its peers in terms of having 1400MW of renewable wind purchases. Kim continued to stress that TVA is utilizing the IRP in order to help optimize decision making. TVA strives for "no regrets decisions," meaning a decision isn't made too soon or too late.

An additional question raised during Kim's opening comments was:
- Will new Board members be on by August 2010? This is unlikely.

After Kim addressed the SRG, Randy McAdams went over the agenda for the two day working session. The main topics of the two day agenda are on the outputs of the IRP analysis process.

The four fundamental focuses of this working session are: (1) defining the capacity gap – how the inputs translate into a capacity gap (2) portfolio expansion plan – the outputs of the IRP modeling process (3) portfolio operating characteristics (GWh produced, CO2 produced, etc.) (4) financial implications of the portfolios. Randy emphasized that today would be a very data intensive day.

I. **Introduction**

Randy McAdams reminded the Stakeholder Review Group of their purpose in the IRP process and read the charter of the SRG which includes providing in-depth and ongoing discussion, serving as a source of information and a coordination mechanism, and to build efficiency into the process.

The IRP has entered phase three which is the evaluation of preliminary model results. McAdams pointed out that there are some confidential slides in today's presentation and that those that have not signed confidentiality agreements will be asked to leave the room when these slides are displayed.

Van briefly welcomed and thanked the SRG and emphasized that there is a lot of visibility and dialogue on the IRP within the agency and that he looks forward to two full days with the SRG.

II. **Defining the Capacity Gap**

This portion of today's agenda looks at defined model inputs and how we are going to satisfy "what we need" (the capacity gap) based on all the input assumptions and

parameters. The capacity gap is defined by the shortfall between existing resources and firm requirements. This gap is what TVA is trying to fill with new or existing resource options and represents the portion that the model must solve for after specified model inputs are applied.

Gary showed the planning strategy matrix and showed which attributes are loaded into the model versus which attributes the model optimizes after the inputs are loaded into the model. Next, he went over how to interpret the capacity gap for each strategy. The charts shown are based on summer net dependable capacity and are meant to show the "gap" that the model has to solve for. The defined model inputs combined with TVA's existing firm assets define the remaining capacity gap for each strategy.

Strategies that have a greater amount of model inputs defined have less of a "gap" to optimize with other existing or future generation. For example, Strategy A has no fossil lay ups so there would be less of a capacity gap to fill compared to a strategy such as Strategy D which implements a substantial amount of fossil layups.

Next, Gary went over firm requirements. Firm requirements are forecasted for peak demand and adjusted for interruptibles. Gary showed a chart of firm requirements for all scenarios, another component of the capacity gap analysis. This showed that there is a 20,000 MW range of capacity gaps among the seven scenarios. Firm requirements are defined by:

Firm requirements = load forecast – interruptibles + reserve margin (15%)

There were some confidential slides in this presentation so those that have not signed confidentiality agreements were asked to exit the room.

Overall, this portion of the working session illustrated that Scenario 1 is the driver on the upside, meaning it is fairly aggressive, and Scenario 6 is the driver on the downside, where basically no new generation is added. In between these is the range that the model must optimize for.

III. **Portfolio Expansion Plans**

In this section, portfolio expansion plans were illustrated in separate graphics by scenario. Within each chart, each strategy is "laid" on the scenario chart and the expansion plan for each strategy is shown in five year snapshots according to the scenario in order to compare how strategies "behave" within one scenario. The existing system is not portrayed in these charts, only the MW of added capacity. Board approved projects are included in certain strategies, such as a combined cycle being placed at a fossil plant and the refurbishment of the Gleason combustion turbine plant.

There are some restrictions placed on the model to reflect reality. An example of an applied model restriction is: not allowing the model to pick nuclear before 2018 due to the long lead time required to apply for permit, receive permit approval, and construct a nuclear plant.

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Portfolio Expansion Plans (continued)

The second set of graphics shows separate charts by strategy. Each of the seven scenarios is "laid" on top of one strategy chart in order to compare capacity additions in each scenario within one strategy. There was a confidential slide in this presentation so those who haven't signed confidentiality agreements were asked to exit the room.

It was requested that a scenario of the most "current situation" be included. This will be done during the sensitivity phase between draft and final.

The second part of the Portfolio Expansion Plans portion of the working session focused on Unit Addition Schedules. These are shown in a table format and are shown strategy by strategy. Within each Unit Addition Schedule table, all unit additions are shown within each scenario by year in one strategy, meaning there is a separate table of unit additions for each strategy. In many of the expansion plans, there are no purchases in the scenarios – the model has the option but in many cases additions were not needed. This further emphasizes the point that what is chosen in the model is just as important as what isn't chosen.

All of the resources included in the unit addition schedules are adjusted for their summer net dependable capacity. Every time the model evaluates a unit being available in a particular year, the cost is estimated and is "escalated" as the model goes further into the project time period. A proper time gap is maintained between the additions of nuclear units in order to realistically portray construction constraints.

Questions and comments received included:

- Do you use the same escalation factor for all technologies? It was explained that there are different escalation factors used for different technologies as well as in different scenarios.
- Have you compared analysis between AP1000 and B&W? Yes, AP1000 is not as cost effective, but does get chosen later in some scenarios.
- Is there assumed carbon capture sequestration technology? Yes, on coal units. It is assumed that the technology will not be mature enough for implementation until 2025.

Gary moved onto another set of graphics. These graphics were a series of histograms with the x-axis labeled "number of units added" and the y-axis labeled "number of portfolios." For example, one histogram illustrated how many portfolios (20 year expansion plans) chose nuclear and how many units were chosen; the same was done with coal units, combined cycle units, and combustion turbine units.

IV. **Portfolio Operating Characteristics**

These graphics are shown by scenario with each strategy "laid" on top of the scenario to compare how strategies perform within a scenario. These charts illustrate the energy mix in five year increments within each strategy per one scenario. The energy mix is portrayed as percent of total GWh. The graphic shows the percentage of each resource that makes up the energy mix. The reason for showing the energy mix as percents is to illustrate which resources contribute the most as well as which resources move around the most in the strategies (as opposed to the gross GWh that is produced). EEDR is shown as "pushing down" on the other resources, meaning if a strategy has more EEDR implemented there will be fewer resources

needed to fill the rest of the capacity gap. The model can pick up to 900MW of firm purchases (an annual limit) and applies market prices that have been benchmarked.

Questions and comments received included:
- Request to see the source data behind the energy mix percent charts and/or convert energy mix charts from percent to GWh.
- Some concern of having fixed blocks of energy efficiency rather than basing on opportunities in the market place
- Inquiry on if TVA has looked at how close its actual load is compared to average load (in terms of peak)

Observations taken from this portion of the working session included a table showing the range of energy production by type in 2025. The percentage of generation from hydro plants is included in the renewables percentage. Percent of gas generation added may seem lower compared to other utilities in the southeast due to TVA's ability to easily and economically get coal from several locations.

The next portion of portfolio operating characteristics is the CO_2 Indicator Charts. Two CO_2 indicators are shown in these charts: tons and intensity. The graphs are shown by scenario with the strategies "laid" out on the scenario in order to compare how each strategy performs within a scenario. Scenario 6 appears to behave the most differently compared to the other scenarios and strategy D has the lowest tons of carbon across all strategies (due to the amount of layups in this strategy).

Day Two: July 21, 2010

Members Present:
Randy McAdams, Facilitator, ScottMadden
Dana Christensen, Oakridge National Laboratory
Ryan Gooch, State of Tennessee
Louise Gorenflo, Sierra Club
Richard Holland, Packaging Corporation of America
David McKinney, Tennessee Wildlife Resource Agency
David Reister, Environmental Stakeholder
Jack Simmons, Tennessee Valley Public Power Association
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I. **Recap from Day One:**

Randy McAdams welcomed the SRG members and alternates for the second day of the working session. The section on Financial Implications, which was on yesterday's agenda, is being presented today.

II. **Financial Implications**

Gary showed an example of financial implications from one of the scenario and strategy intersections. He went over how to interpret the table and emphasized which elements of cost are important in ranking and which elements are not.

The main goal of utility planning is to minimize the net present value of revenue requirements. Present value revenue requirements (PVRR) include all revenue that is needed in order to operate a particular system into the future. Using net present value makes it easier to compare unequal levels of investment in different years. There is a present value factor applied to all annual cash flow and discounted cash flow numbers. One observation noted when looking at the financial implications is that actions in the out years of the plan have little impact on the total plan cost.

Present value was applied to each resource plan in order to see how the five strategies behave compared to each other within one scenario. For example, Scenario 1 shows a high PVRR which translates to a lot of building. Scenario 6 shows a low PVRR , which translates to not a lot of building. The more expensive strategies tend to have the most layups which means there will most likely be building of new generation.

Gary showed a "tornado diagram" that portrayed the variation of PVRR as a result of distribution probabilities that came out of the financial analysis. This shows how the distribution relates across the five strategies and how it changes across the scenarios. The wider the bar, the wider the variation of a resource plan (meaning, aggressive growth, additions to plan, uncertainty, etc.).

In order to calculate how to fund a plan, the model takes planning assumptions and calculates the rate increase that is necessary to fully fund rate requirements in a certain plan. A $28 billion debt cap, which is lower than TVA's actual debt cap, is used in the model in order to have a bit of reserve margin. Once the costs reach the debt cap in the model, the rest of the expenses are covered with rates. All financial requirements and costs, such as construction requirements, are implemented into this financial model. One of the purposes of using this financial model is to find a balance point between going in the direction TVA wants to go and going in a direction where TVA can afford to go.

Short term rate impacts are a specific metric used in the IRP analysis. Short term rate impacts include capital investment items such as clean air controls necessary to meet CAIR, basically the cost of maintaining compliance of fossil fleet operations in addition to new generation builds.

It was requested to see an example of PVRR where Bellefonte is proposed to be built in terms of short term rate impacts and assumptions across plans. There was also a request made to view the ranges of the 13 stochastic variables used in the financial analysis.

Next, Gary moved on to show risk ratios in terms of distribution of revenue requirements. There are two types of risk assessed: risk averse and risk seeking.

Risk averse addresses the question of how volatile a plan's expected cost could potentially be. The best score here is 0, meaning there is a narrow distribution and less risk. Risk seeking assesses the risk/benefit ratio. If a plan has a value of more than 1, the risk is greater than the benefits. All of these factors help TVA with trade off analyses. Observations from this portion of the working session included: Strategy A has the highest risk ratios across the board and Strategy C tends to have the lowest risk.

It was requested to provide the updated load growth percentage. There were questions around how economic recession impacts the risk assessment as well as if variability is constrained by only using the scenario concepts to apply risk.

III. **Ranking Metrics and Strategic Indicators**

Ranking Metrics

Gary reviewed how the scorecard is constructed with the SRG. Ranking metrics appear on the left and strategic metrics appear on the right. Gary went over the three steps of the scorecard process. The first step is to rank the strategies by applying cost and risk metrics to each portfolio. The portfolios are then summed within one strategy to produce an overall strategy score. Once the best performing strategies are identified, strategic metrics are then applied to further evaluate the plans to be considered. Strategic metrics and ranking metrics will be developed for all portfolios that are going to be maintained in the draft IRP, which is the overarching purpose of the scorecard process. Part of the IRP process between the draft and final includes applying sensitivities to some of the strategies in order to do a "double check" and see if there are any flaws within assumptions.

As of now, Strategy C looks to be performing the best, but Strategies B and E are still of interest because their scores fall second behind Strategy C. Once the preferred strategies are selected, the best performing portfolios will be selected to represent these strategies.

Strategic Metrics

There are three strategic metrics: environmental, economic development, and technology innovation.

John Myers, Director of Environmental Policy, Clean and Renewable Energy, gave a presentation on the environmental part of the strategic metrics. John will be addressing the environmental portion of the strategic indicator portion of the scorecard. It is envisioned that this portion of the scorecard will be a composite metric which will include air, water, land, and waste aspects. To start this assessment, it was crucial to consider the future environmental outlook in terms of which generation technologies will be heavily regulated in the future.

Air: when you look at the air emissions from all 35 portfolios and compare to the CO2 footprints of those portfolios, the trends are very similar. One thing that is embedded into air emissions data is the assumption that operating coal units will be controlled in the later years.

Water: Have heard concerns of thermal impacts on water due to discharge from SRG members. TVA is assessing the thermal load going to the condensers and using the thermal load as a proxy to rate water issues. TVA is reviewing all technologies for dealing with cooling water issues, such as closed cycle systems.

Waste: The metric is calculating the mass of waste generated (primarily coal and nuclear) and then applies handling costs to each unit ($/ton) to compare waste. It is noted that as TVA transitions from wet to dry ash storage, this will also reduce some of the load that may end up in water.

Comments and requests during this portion
- A request was made for the waste impact data used in the environmental strategic metric
- A request was made for the radioactive waste proxy used to normalize
- Need to include air in the environmental strategic metric
- How are you approaching coming into compliance with thermal limitations?

Next, Juan Gonzalez, TVA Economist, gave a presentation on the economic aspect of the strategic metrics that is part of the IRP scorecard. The process used is a standard process utilized by many federal agencies including the EPA and other state agencies. The model is called REMI and captures the relations of initial actions and the resulting effect on the economy – what is going in and out of the TVA region compared to what is not. This model was also used in TVA's Reservoir Operations Study. The model assesses the tradeoff for customers to pay for electricity versus their decisions to spend money on other things.

The inputs for this model, described as "direct effects," are things such as resource expenses and electricity price. Outputs or the "multiplier effects" for this model include population, employment, and personal income.

The economic drivers are an indirect part of what shapes the load forecasts that are integral to the seven scenarios. It was reminded that the reason TVA is utilizing an economic strategic metric is because TVA has an economic mission and is trying to "do good" with this metric, not "do bad."

- Does the model you are running account for investment inside or outside the valley [for renewables]? – the model spits out jobs, economic development and investment
- Can the model reflect the reality of the Tennessee valley region being in position to be a clean energy producer?
- Make sure the economic development indicators are appropriate assessments
- Look into using the JEDI model
- Can the model assess the impact of Energy Efficiency consumer savings in economic development?

Lastly, Gary Brinkworth presented on the technology innovation strategic metric. The purpose of this metric is to assist TVA in understanding the agency's direction in the Strategic Plan. This metric will not be fully formed until after the draft document is released.

This metric is meant to be a qualitative measure of how TVA can be a leader in a certain technology. As of now, this is an area that is not fully secure within the agency. TVA tends to dabble in a lot of areas and the agency is attempting to pick technological areas in which TVA can make a difference and be a leader rather than having several small projects. It will be an indicator that will help the agency understand whether its actions are promoting or hindering technological advancement.

Questions and Comments during this section:
- Consider looking into carbon capture sequestration (CCS) technology – the industry needs a leader in this area
- Implementing smart grid technology that doesn't interfere with local distribution systems
- Some misunderstanding around what TVA is trying to accomplish with this metric

IV. **Preliminary Observations**

Across all the strategies, there is a wide range of capacity that could be added and a wide range of resources to choose from to provide needed capacity. One major observation is that nuclear capacity is prominent throughout the analysis results.

The metrics ranking is based on the scorecards applied to each of the 20 year plans. As it stands now, Strategy C ranks the highest, Strategies E and B rank in the middle, and Strategies A and D rank the worst. Not sure at this point if all strategies will be included in the final IRP document, but will most likely at least include the three best performing in the final IRP document.

During the analysis, the assigned metric weightings were examined to make sure that the assigned weightings are not significantly impacting how the strategies are scoring out. When the weightings were changed dramatically, the scores would change but the order of the strategy scores remained unchanged. Gary showed XY plots (cost vs. rates) to illustrate the tradeoff between two indicators. On these XY plots, the best plan is the one that gives the best balance between the indicators. XY plots were also shown for tons of CO_2 vs. PVRR as well as CO_2 tons vs. short term rates. This will create needed discussion on tradeoffs for the plans.

In terms of EEDR, strategies C and E consider upwards of 10% of demand being met by EEDR. Investment in the technology innovation area will be the main area that will contribute to this. All the strategies include imbedded costs for EEDR.

The draft IRP, as it appears now, will imply that strategy C is going to be TVA's best strategy to implement. Strategies B and E will be included in the draft as well. These strategies will most likely be represented by three of the best portfolios within one strategy. TVA has chosen to do this because a number of the expansion plans are very similar and there is no need to include duplicate plans.

Comments and Questions during this portion of the presentation included:

- Considering talking to the Board about TVA's rate structure and how it can support a preferred strategy
- Technology innovation aspect of scorecard needs to be more defensible
- Economic indicator – looking at which types of investment choices place jobs

V. **Next Steps and Wrap Up**

The next step is to run sensitivities on the identified plans to go into the draft document. Some sensitivities have already been identified such as:

- Testing the responsiveness of strategy C when weightings of the metrics are shifted around
- Strategy C without a pumped hydro unit
- Changing some assumptions around EEDR
- Also looking at sensitivities around strategy E because it has a large amount of layups and EEDR contribution is substantial.

SRG members requested to be able to submit sensitivity cases to be run. It was reminded that sensitivity cases take about one week to run per sensitivity. We will solicit input from SRG members but ask that with each request include a small note with the reason for applying a sensitivity.

Next, it was discussed how the SRG will move forward in the IRP process once the draft is released. For the draft, there will be three strategies included which will be represented by the best performing portfolios. The SRG expressed a desire to stay involved and hold meetings into the fall and winter up to the final IRP release.

The meeting was adjourned.